Title: METHOD AND APPARATUS FOR REPRESENTING FILE
SYSTEM METADATA WITHIN A DATABASE FOR EFFICIENT
QUERIES
1st Named Inventor: Vijay Deshmukh
Express Mail No.: EV409365123US   Docket No.: 5693P048
Sheet: 1 of 7

FIG. 1

Blakely, Sokoloff, Taylor & Zafman LLP   (408) 720-8300
Title: METHOD AND APPARATUS FOR REPRESENTING FILE
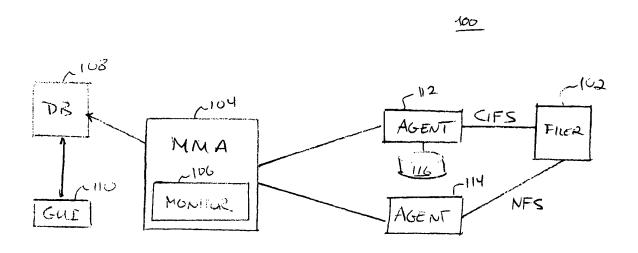SYSTEM METADATA WITHIN A DATABASE FOR EFFICIENT
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FIG. 2

200

201
1

202
2

207
7

703
3

206
6

8
208

210
10

4
204

5
205

9
209

300

FIG. 3

NODE ~302	PARENT ~304
1	0
2	1
7	1
3	2
6	2
8	7
10	7
4	3
5	3
9	8

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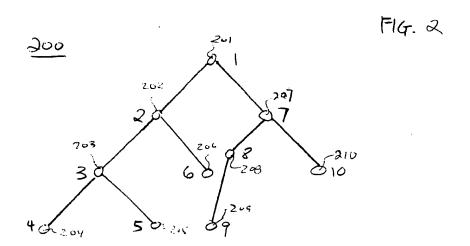SYSTEM METADATA WITHIN A DATABASE FOR EFFICIENT
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FIG. 3B   <u>300</u>

~302   ~304   ~352   ~354   ~356

NODE	PARENT	SIZE	CREATION TIME	NAME
1	0	4.1 GB	3/1/2003 12:00a	/u/
2	1	812 MB	3/1/2003 1:00a	/u/employees/
7	1	1.2 GB	3/1/2003 1:02a	/u/administrators/
3	2	704 MB	3/14/2003 2:14p	/u/employees/a-m/

FIG. 3C   <u>370</u>

```
1   /u/
2   ├── /u/employees/
3   │    ├── /u/employees/a-m/
4   │    │    ├── /u/employees/a-m/baker/
5   │    │    └── /u/employees/a-m/jones/
6   │    └── /u/employees/n-z/
7   └── /u/administrators/
8        ├── /u/administrators/sysadmin/
9        │    └── /u/administrators/sysadmin/logfiles/
10       └── /u/administrators/accounts/
```

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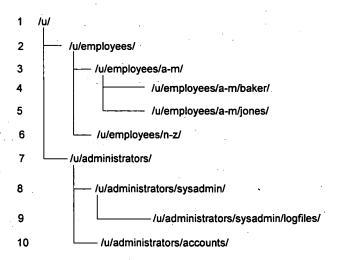Express Mail No.: EV409365123US   Docket No.: 5693P048
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400

FIG. 4

```
                    ┌─────────────┐
                   (    Start      )
                    └──────┬──────┘
                           │
                           ▼
         ┌─────────────────────────────────────┐
         │                                       │
         │         Scan a storage server         │
         │                                       │
         │                              402      │
         └─────────────────┬─────────────────────┘
                           │
                           ▼
         ┌─────────────────────────────────────┐
         │                                       │
         │   Collect data regarding a directory  │
         │               structure               │
         │                              404      │
         └─────────────────┬─────────────────────┘
                           │
                           ▼
         ┌─────────────────────────────────────┐
         │                                       │
         │  Assign IDs to directories according  │
         │            to a DFS order             │
         │        while collecting the data      │
         │                              406      │
         └─────────────────┬─────────────────────┘
                           │
                           ▼
         ┌─────────────────────────────────────┐
         │                                       │
         │   Write a table including the ID      │
         │              numbers                  │
         │                              408      │
         └─────────────────┬─────────────────────┘
                           │
                           ▼
                    ┌─────────────┐
                   (     End       )
                    └─────────────┘
```

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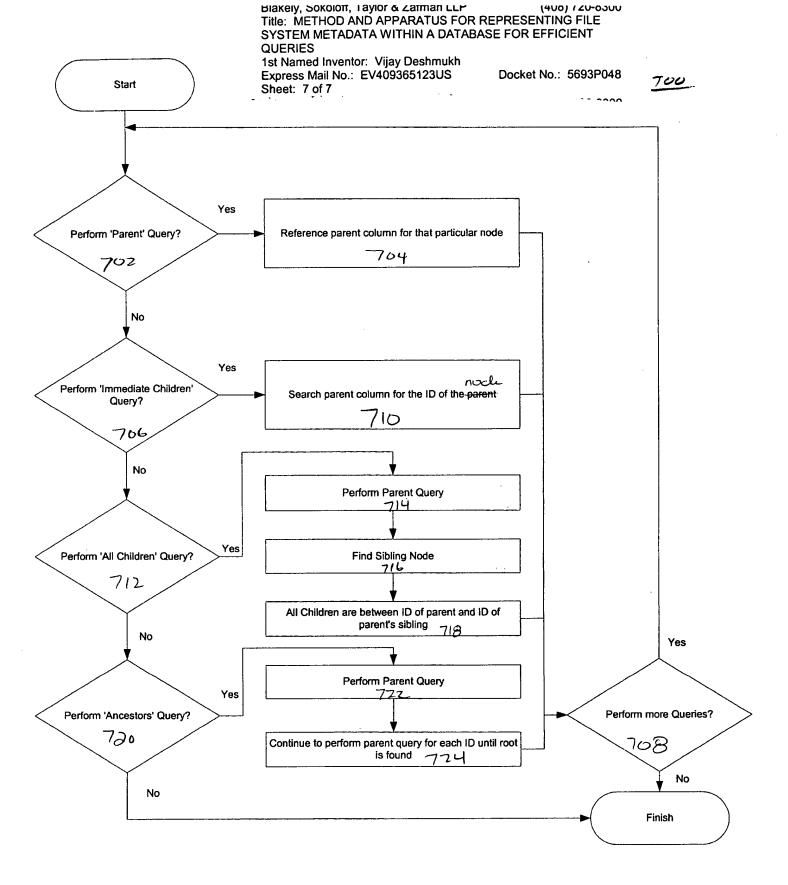
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Start

Add root directory to directory queue

502

End of directory queue?

504

Yes

No

Directory Walking Thread examines next entry in directory queue

506

Place children of examined directory in file queue and assign DFS ID to directory

508

End of file queue?

510

Yes

No

File thread examines next entry In file queue

512

Is file queue entry a directory?

514

Yes

Add file queue entry to directory queue

516

No

Record Data about the file

518

Finish

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FIG. 6A

Directory Queue ~602
root

File Queue ~604

Tree ~606   600

FIG. 6B

Directory Queue ~602

File Queue ~604
/u/
system.file

Tree ~606   600
φ Root (0)

FIG. 6C

Directory Queue ~602
/u/

File Queue ~604

Tree ~606   600
φ Root (0)

FIG. 6D

Directory Queue ~602

File Queue ~604
/employees/
/administrators/
users.cfg

Tree ~606   600
ο Root (0)
ο /u/ (1)

FIG. 6E

Directory Queue ~602
/employees/
/administrators/

File Queue ~604

Tree ~606   600
φ Root (0)
ο /u/ (1)

FIG. 6F

Directory Queue ~602
/administrators/

File Queue ~604
/a-m/
/n-z/
list.cfg

Tree ~606   600
φ Root (0)
φ /u/ (1)
ο /employees/ (2)

FIG. 6G

Directory Queue ~602
/a-m/
/n-z/
/administrators/

File Queue ~604

Tree 606   600
φ Root (0)
φ /u/ (1)
ο /employers/ (2)

FIG. 6H

Directory Queue ~602
/n-z/
/administrators/

File Queue ~604
/baker/
/jones/
index.cfg

Tree 606   600
ο Root (0)
ο /u/ (1)
ο /employees/ (2)
ο /a-m/ (3)

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700

Start

Perform 'Parent' Query? — Yes → Reference parent column for that particular node
702
704

No

Perform 'Immediate Children' Query? — Yes → Search parent column for the ID of the node
706
710

No

Perform 'All Children' Query? — Yes → Perform Parent Query
712
714

↓

Find Sibling Node
716

↓

All Children are between ID of parent and ID of parent's sibling
718

No

Perform 'Ancestors' Query? — Yes → Perform Parent Query
720
722

↓

Continue to perform parent query for each ID until root is found
724

No

Perform more Queries?
708

Yes

No

Finish

FIG. 7